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(54) ALUMINUM CLAD STEEL SHEET

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an aluminum clad steel sheet having an excellent adhesion without swelling.

SOLUTION: The copper of 0.1-50g/mm in terms of the amount of copper is clad on one side surface of an electrolytic iron foil, rolled steel foil or a steel sheet, an aluminum or aluminum alloy foil or sheet of 5-300μm in thickness is clad on it, and a copper, nickel, chrome, tin, zinc, lead or alloy composing of these main constituents are clad on the other side surface of the electrolytic iron foil, rolled steel foil or steel sheet. Also, the copper, nickel, chrome, tin, zinc, lead or alloy composing of these main constituents are clad on one side surface or both side surfaces of the electrolytic iron foil, rolled steel foil or steel sheet, the copper of 0.1-50g/mm in terms of the amount of copper is clad on it, and the aluminum or aluminum alloy foil or sheet of 5-300μm in thickness is further clad on it.

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ABSTRACT:

PROBLEM TO BE SOLVED: To provide an aluminum clad steel sheet having an excellent adhesion without swelling.

SOLUTION: The copper of 0.1-50g/mm in terms of the amount of copper is clad on one side surface of an electrolytic iron foil, rolled steel foil or a steel sheet, an aluminum or aluminum alloy foil or sheet of 5-300μm in thickness is clad on it, and a copper, nickel, chrome, tin, zinc, lead or alloy composing of these main constituents are clad on the other side surface of the electrolytic iron foil, rolled steel foil or steel sheet. Also, the copper, nickel, chrome, tin, zinc, lead or alloy composing of these main constituents are clad on one side surface or both side surfaces of the electrolytic iron foil, rolled steel foil or steel sheet, the copper of 0.1-50g/mm in terms of the amount of copper is clad on it, and the aluminum or aluminum alloy foil or sheet of 5-300μm in thickness is further clad on it.

* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The aluminum-clad steel plate with which it converts into a copper quantity, 0.1-50g [/mm] copper is covered by one side of an electrolytic iron foil, a rolled-steel foil, or a steel plate, the foil or plate of aluminum with a thickness of 5-300 micrometers or an aluminium alloy is covered on it, and the alloy which makes a principal component copper, nickel, chromium, tin, zinc, lead, or these in other fields of said electrolytic iron foil, a rolled-steel foil, or a steel plate is covered.
[Claim 2] The aluminum-clad steel plate with which the alloy which makes a principal component copper, nickel, chromium, tin, zinc, lead, or these was covered, it converted into the copper quantity on it, 0.1-50g [/mm] copper was covered by one side or both sides of an electrolytic iron foil, a rolled-steel foil, or a steel plate, and the foil or plate of aluminum with a thickness of 5-300 micrometers or an aluminium alloy was further covered on it.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] It is related with the aluminum-clad steel plate excellent in processing adhesion.
[0002]
[Description of the Prior Art] Development of the clad plate of aluminum and a steel plate is furthered by various approaches. For example, there are cold rolling conjugation methods (JP,53-85759,A etc.), organic adhesives methods (JP,60-223683,A etc.), etc. However, there is a fault of being inferior to processing adhesion, by existence of the oxide film which exists on the surface of aluminum.
[0003]
[Problem(s) to be Solved by the Invention] The technical technical problem of this invention is offering the aluminum-clad steel plate excellent in processing adhesion with low welding pressure, without using adhesives.
[0004]
[Means for Solving the Problem] The clad plate of this invention is converted into a copper quantity at one side of an electrolytic iron foil, a rolled-steel foil, or a steel plate, 0.1-50g [/mm] copper is covered, the foil or plate of aluminum with a thickness of 5-300 micrometers or an aluminium alloy is covered on it, and the alloy which makes a principal component copper, nickel, chromium, tin, zinc, lead, or these in other fields of said electrolytic iron foil, a rolled-steel foil, or a steel plate is covered. Moreover, the alloy which makes a principal component copper, nickel, chromium, tin, zinc, lead, or these is covered by one side or both sides of an electrolytic iron foil, a rolled-steel foil, or a steel plate, a clad plate according to claim 2 is converted into a copper quantity on it, 0.1-50g [/mm] copper is covered, and the foil or plate of aluminum with a thickness of 5-300 micrometers or an aluminium alloy is further covered on it.
[0005]
[Embodiment of the Invention] The steel foil or the steel plate used for the aluminum-clad steel plate of this invention means the steel plate manufactured by the electrolytic decomposition process or the rolling-out method. Moreover, the steel plate which covered a low-carbon steel plate, a chromium addition steel plate, the steel plate that carried out nickel diffusion process and copper, nickel, chromium, tin, zinc, lead, or the alloy that made these the principal component as a steel plate is contained. Of course, chromate treatment and phosphate processing can be performed to the field which does not cover the aluminium foil or the plate of said steel plate. On the other hand, the rolling foil or rolled plate which consists of aluminum or an aluminium alloy is the aluminum with a thickness of 5-300 microns or the aluminium alloy plate manufactured by the rolling-out method. As an aluminium alloy plate, the alloy plate containing magnesium, manganese, silicon, copper, iron, zinc, chromium, titanium, or a zirconium is contained. Workability falls by the thickness of less than 5 microns, a manufacturing cost becomes high, and it is uneconomical.
[0006] Moreover, if 300 microns is surpassed, it is uneconomical in respect of an ingredient. Next, in order to acquire the good junction force and processing adhesion, on the front face of steel foil, a steel

plate, aluminum, or an aluminium alloy plate, the alloy which used copper or copper as the principal component is converted into a copper quantity, and is covered two times mm 0.1-50g /. 1-30g /is covered two times mm preferably.
[0007] It is easier to join the direction which removed the oxide of the front face of aluminum to homogeneity. Moreover, the alloy which used copper or copper as the principal component may be covered on the front face of both metal plates. In that case, the amount of total coppers in a plane of composition should just be 0.1 - 50 g/m2. In less than two 0.1 g/m, if sufficient junction force is not acquired but 50 g/m2 is exceeded, it is uneconomical in respect of a manufacturing cost.
[0008] Moreover, before covering the alloy which used copper or copper as the principal component to a copper plate, nickel, chromium, tin, zinc, lead, or the alloy that made these the principal component may be covered two times 0.01 to 50 g/m.
[0009] Moreover, copper, nickel, chromium, tin, zinc, lead, or the steel plate that covered the alloy which made these the principal component may be used beforehand. However, in the case of the alloy which used chromium or chromium as the principal component, you may cover two times 0.01 to 2 g/m.

[0010] Moreover, when covering an aforementioned metal or an aforementioned alloy beforehand and covering the alloy which used copper or copper as the principal component What is necessary is to convert into a copper quantity and just to cover two times 0.1 to 50 g/m., desirable -- What is necessary is just to cover two times 0.5 to 20 g/m. Thus, if nickel, chromium, tin, zinc, lead, or the alloy that made these the principal component is covered beforehand, a binder course will become homogeneity more and adhesion will be improved more.
[0011] Workability is inferior when 50 g/m2 and the amount of chromium exceed [the amount of nickel] 2 g/m2. As an approach of covering copper, nickel, chromium, tin, zinc, lead, or the alloy that made these the principal component, there are electroplating, chemical plating, the vacuum deposition galvanizing method, etc.
[0012] Cobalt, a bismuth, iron, germanium, an indium, manganese, molybdenum, nickel, tin, antimony, a tellurium, a thallium, zinc, a tungsten, etc. are included in the alloy which used copper as the principal component.
[0013] Niobium, chromium, aluminum, a rhodium, titanium, cobalt, copper, iron, germanium, an indium, manganese, molybdenum, tin, antimony, a tellurium, a thallium, zinc, a tungsten, etc. are included in the alloy which used nickel as the principal component.
[0014] Vanadium, cobalt, iron, manganese, molybdenum, tin, a tungsten, nickel, etc. are included in the alloy which used chromium as the principal component.
[0015] A zirconium, vanadium, a thallium, antimony, lead, copper, an indium, cobalt, iron, manganese, molybdenum, tin, a tungsten, nickel, etc. are included in the alloy which used zinc as the principal component.
[0016] Zinc, germanium, chromium, a bismuth, antimony, lead, copper, an indium, cobalt, iron, manganese, molybdenum, a tungsten, nickel, etc. are included in the alloy which used tin as the principal component.
[0017] Although what is necessary is just not to need welding pressure especially at the time of heating, but to only pile up a plate at it, in order to join to homogeneity, it is good to pressurize in the range of 0.01 - 200 kgf/cm2 preferably.
[0018] Heating is the ambient atmosphere of a vacuum, inactive, and a non-oxidizing quality, and makes a foil and a plate the temperature (about 650 degrees C) of under the melting point of 300 degrees C - aluminum, or an aluminium alloy. At less than 300 degrees C, it is inferior to adhesion, and above the melting point, since aluminum fuses, workability is worsened.
[0019] Although heating time changes with the metaled classes and thickness to cover, it is good at 0.1 seconds - about 15 minutes. It is uneconomical, if it is hard to stick to homogeneity and 15 minutes is surpassed in less than 0.1 seconds.
[0020] Aluminum clad can be given to one side or both sides of steel foil or a steel plate. A non-oxidizing atmosphere, for example, hydrogen, nitrogen, helium, neon, argons, or these mixed gas of an

ambient atmosphere is desirable.
[0021] On the other hand, aluminum is aluminium foil with a thickness of 5-100 micrometers manufactured by the rolling-out method. If workability falls by the thickness of less than 5 micrometers and 100 micrometers is exceeded, it is uneconomical in respect of the cost of materials. Moreover, chemical conversion, such as chromate treatment and phosphating, can be performed to a non-plane of composition.
[0022] In case aluminum is joined to a steel plate with cold rolling, the alloy plating which used nickel or nickel as the principal component is first performed to a steel plate 0.5-5g[/m] 2. Although especially the approach of covering the alloy which used nickel or nickel as the principal component is not restricted, it has electroplating and chemical plating as these approaches. Lynn, cobalt, copper, chromium, zinc, tin, or iron can be included in the alloy which used nickel as the principal component.
[0023]
[Example]
(Example 1) Aluminium foil (JIS1100 material) with a thickness of 100 micrometers was immersed for 5 seconds on conditions with a temperature of 60 degrees C into the solution containing p-3 ANZA (Henkel Hakusui make) 30 g/l. Copper was galvanized two times 50 g/m on condition that 50 degrees C and current density 5 A/dm2 using the solution which contained copper pyrophosphate 90 g/l and potassium-pyrophosphate 330 g/l in the steel plate with a thickness of 200 micrometers. Subsequently, the steel plate which carried out copper plating to aluminium foil was piled up, pressure 0.04 kgf/cm2 was applied, in the ambient atmosphere containing 95% of nitrogen gas, and 5% of hydrogen gas, it heated at the temperature of 610 degrees C of a plate for 10 minutes, and the aluminum-clad steel plate was obtained.
[0024] (Example 2) Aluminium foil (JIS1070 material) with a thickness of 5 micrometers was immersed for 5 seconds on conditions with a temperature of 60 degrees C into the solution containing sodium-hydroxide 50 g/l. The steel plate with a thickness of 250 micrometers was immersed using 50-degree-C solution containing copper-sulfate 250 g/l and sulfuric-acid 50 g/l, and 20g /of copper was galvanized two times m to both sides. Subsequently, aluminium foil was put on both sides of the steel plate which carried out copper plating, pressure 1.0 kgf/cm2 was applied, in the ambient atmosphere containing 95% of nitrogen gas, and 5% of hydrogen gas, it heated for 1 second at the temperature of 610 degrees C of a plate, and the aluminum-clad steel plate was obtained.
[0025] (Example 3) Copper was galvanized two times 10 g/m on condition that the temperature of 40 degrees C, and current density 5 A/dm2 in the solution which contained copper-sulfate 250 g/l and sulfuric-acid 50 g/l for the aluminium alloy foil (JIS3003 material) with a thickness of 30 micrometers. Subsequently, the aluminium alloy foil which carried out copper plating was put on the steel plate with a thickness of 200 micrometers, pressure 0.5 kgf/cm2 was applied, in the ambient atmosphere of hydrogen gas, it heated for 30 seconds at the temperature of 600 degrees C of a plate, and the aluminum-clad steel plate was obtained.
[0026] (Example 4) It was processed for 5 seconds on condition that current density 10 A/dm2 at the temperature of 60 degrees C in the solution which contained sodium-hydroxide 100 g/l for aluminium foil (JIS1070 material) with a thickness of 50 micrometers, having used aluminium foil as cathode. The Watts bath (nickel-sulfate 240 g/l, nickel chloride 45 g/l, boric-acid 30 g/l) was used for steel foil with a thickness of 100 micrometers, and nickel was galvanized two times 0.01 g/m on condition that the temperature of 50 degrees C, and current density 5 A/dm2. Subsequently, copper was galvanized two times 3 g/m on condition that the temperature of 50 degrees C, and current density 5 A/dm2 using the solution which contained copper-sulfate 250 g/l and sulfuric-acid 50 g/l in the steel foil which carried out nickel plating. Subsequently, the steel foil which carried out after [nickel plating] copper plating to aluminium foil was piled up, pressure 0.04 kgf/cm2 was applied, in the argon gas ambient atmosphere, it heated at the temperature of 630 degrees C of a foil for 1 minute, and the aluminum-clad steel plate was obtained.
[0027] (Example 5) Copper was galvanized two times 2 g/m on condition that the temperature of 40 degrees C, and current density 5 A/dm2 in the solution which contained a 250g [/l.] copper sulfate and

sulfuric-acid 50 g/l in the aluminium alloy plate (JIS5052 material) with a thickness of 200 micrometers. To subsequently, steel foil with a thickness of 70 micrometers Copper was galvanized two times 3 g/m on condition that 50 degrees C and current density 5 A/dm2 using the solution containing copper pyrophosphate 90 g/l and potassium-pyrophosphate 330 g/l. Subsequently, the steel foil which carried out copper plating to the aluminium alloy plate which carried out copper plating was piled up, pressure 0.01 kgf/cm2 was applied, in the ambient atmosphere containing 95% of nitrogen gas, and 5% of hydrogen gas, it heated for 1 second at the temperature of 650 degrees C of a plate, and the aluminum-clad steel plate was obtained.

[0028] (Example 6) Copper was galvanized two times 10 g/m on condition that 50 degrees C and current density 5 A/dm2 using the solution which contained copper pyrophosphate 90 g/l and potassium-pyrophosphate 330 g/l in the aluminium alloy plate (JIS5082 material) with a thickness of 300 micrometers. Subsequently, the Watts bath (nickel-sulfate 240 g/l, nickel chloride 45 g/l, boric-acid 30 g/l) was used for steel foil with a thickness of 30 micrometers, and nickel was galvanized two times 0.5 g/m on condition that the temperature of 50 degrees C, and current density 10 A/dm2. Using the solution which contained copper-sulfate 30 g/l, ferrous-sulfate 300 g/l, and ammonium-sulfate 30 g/l in this steel foil that carried out nickel plating, on condition that the temperature of 50 degrees C, and current density 10 A/dm2, copper-iron alloy plating was converted into copper and galvanized two times 5 g/m. Subsequently, the aluminium alloy plate which carried out copper plating, and the steel foil which carried out after [nickel plating] copper-iron alloy plating were piled up, pressure 10 kgf/cm2 was applied, in the ambient atmosphere containing 95% of nitrogen gas, and 5% of hydrogen gas, it heated at the temperature of 590 degrees C of a plate for 1 minute, and the aluminum-clad steel plate was obtained.

[0029] (Example 7) Using the solution which contained copper-sulfate 5 g/l, nickel-sulfate 5 g/l, ammonium tartrate 13 g/l, and ammonium hydroxide 0.025 g/l in the aluminium alloy plate (JIS3004 material) with a thickness of 200 micrometers, on condition that the temperature of 30 degrees C, and current density 5 A/dm2, copper nickel alloys were converted into copper and galvanized two times 0.05 g/m. Subsequently, the Watts bath (nickel-sulfate 240 g/l, nickel chloride 45 g/l, boric-acid 30 g/l) was used for the electrolytic iron foil with a thickness of 15 micrometers, and nickel was galvanized two times 50 g/m on condition that the temperature of 50 degrees C, and current density 10 A/dm2. Copper was galvanized two times 10 g/m on condition that 50 degrees C and current density 5 A/dm2 using the solution which contained copper pyrophosphate 90 g/l and potassium-pyrophosphate 330 g/l in this iron foil that carried out nickel plating. Subsequently, the iron foil which carried out after [nickel plating] copper plating to the aluminium alloy plate which carried out copper-nickel-alloys plating was piled up, pressure 50 kgf/cm2 was applied, in the ambient atmosphere containing 95% of nitrogen gas, and 5% of hydrogen gas, it heated at the temperature of 580 degrees C of a plate for 15 minutes, and the aluminum-clad steel plate was obtained.

[0030] (Example 8) Aluminium foil (JIS1070 material) with a thickness of 70 micrometers was immersed for 10 seconds on conditions with a temperature of 60 degrees C into the solution containing p-3 ANZA (Henkel Hakusui make) 30 g/l. The Sargent bath (chromic anhydride 250 g/l, sulfuric-acid 2.5 g/l) was used for the steel plate with a thickness of 210 micrometers, and 0.01g /of chromium was galvanized two times m on condition that 50 degrees C and current density 20 A/dm2. Subsequently, 3g /of copper was galvanized two times m on condition that 50 degrees C and current density 5 A/dm2 using the solution which contained copper pyrophosphate 90 g/l and potassium-pyrophosphate 330 g/l in the steel plate which carried out chrome plating. Subsequently, the steel plate which carried out after [chrome plating] copper plating to aluminium foil was piled up, pressure 2 kgf/cm2 was applied, in nitrogen-gas-atmosphere mind, it heated at the temperature of 600 degrees C of a plate for 15 minutes, and the aluminum-clad steel plate was obtained.

[0031] (Example 9) Using the solution which added the sodium hydroxide in the solution which contained copper pyrophosphate 90 g/l and potassium-pyrophosphate 330 g/l in the aluminium alloy plate (JIS5082 material) with a thickness of 150 micrometers, and was set to pH11.5, it was immersed at 60 degrees C and copper was galvanized two times 0.05 g/m. Subsequently, copper was galvanized two

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times 0.05 g/m on condition that current density 5 A/dm2 at 50 degrees C using the solution which contained copper pyrophosphate 90 g/l and potassium-pyrophosphate 330 g/l in the tin plated steel plate with a thickness of 200 micrometers which covered tin two times 2.8 g/m. This aluminium alloy plate that carried out copper plating, and the tin plated steel plate which carried out copper plating were piled up, pressure 200 kgf/cm2 was applied, in nitrogen-gas-atmosphere mind, it heated at the temperature of 301 degrees C of a plate for 5 minutes, and the aluminum-clad steel plate was obtained.

[0032] (Example 10) The aluminum plate (JIS1100 material) with a thickness of 250 micrometers was immersed for 10 seconds on conditions with a temperature of 60 degrees C into the solution containing p-3 ANZA (Henkel Hakusui make) 30 g/l. The Sargent bath (chromic anhydride 250 g/l, sulfuric-acid 2.5 g/l) was used for steel foil with a thickness of 50 micrometers, and 2g /of chromium was galvanized two times m on condition that 50 degrees C and current density 20 A/dm2. Subsequently, 10g /of copper was galvanized two times m on condition that 50 degrees C and current density 5 A/dm2 using the solution which contained copper pyrophosphate 90 g/l and potassium-pyrophosphate 330 g/l in the steel foil which carried out chrome plating. Subsequently, the steel foil which carried out after [chrome plating] copper plating to the aluminum plate was piled up, pressure 5 kgf/cm2 was applied, in nitrogen-gas-atmosphere mind, it heated at the temperature of 600 degrees C of a plate for 3 minutes, and the aluminum-clad steel plate was obtained.

[0033] Thus, the following processing adhesion tests were performed for the obtained aluminum-clad steel plate. It ******ed 6mm so that an aluminum or aluminium alloy plate side might stretch and come out with an Erichsen tester (Tokyo Koki Seizosho make). The blemish was given until it reached the cross joint in the ferrite section by the cutter at the overhang section of the front face of aluminum or an aluminium alloy plate, and the peel test was compulsorily carried out with the pincettes. Consequently, as for the clad plate of examples 1-10, exfoliation was not seen.

[0034]

[Effect of the Invention] The aluminum-clad steel plate which has the firm junction force in a non-oxidizing atmosphere is obtained by making copper etc. intervene between a steel plate, and aluminum or an aluminum plate. Moreover, if nickel, chromium, tin, zinc, lead, or the alloy that made these the principal component is covered, since diffusion between iron and aluminum will be controlled at the time of heat treatment, a more uniform junctional zone is formed and processing adhesion also improves.

[Translation done.]

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(54)【発明の名称】　アルミニウムクラッド鋼板

(57)【要約】

【課題】　剥れがなく、加工密着性に優れたアルミニウムクラッド鋼板を提供する。

【解決手段】　電解鉄箔、圧延鋼箔又は鋼板の片面に、銅量に換算して０．１～５０ｇ／ｍｍの銅が被覆され、その上に厚み５～３００μｍのアルミニウム又はアルミニウム合金の箔又は板が被覆されており、前記電解鉄箔、圧延鋼箔又は鋼板の他の面に、銅、ニッケル、クロム、錫、亜鉛、鉛又はこれらを主成分とする合金が被覆されている。また、電解鉄箔、圧延鋼箔又は鋼板の片面又は両面に、銅、ニッケル、クロム、錫、亜鉛、鉛又はこれらを主成分とする合金が被覆され、その上に銅量に換算して０．１～５０ｇ／ｍｍの銅が被覆され、さらにその上に厚み５～３００μｍのアルミニウム又はアルミニウム合金の箔又は板が被覆されている。

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【特許請求の範囲】

【請求項１】電解鉄箔、圧延鋼箔又は鋼板の片面に、銅量に換算して０．１～５０ｇ／ｍｍの銅が被覆され、その上に厚み５～３００μｍのアルミニウム又はアルミニウム合金の箔又は板が被覆されており、前記電解鉄箔、圧延鋼箔又は鋼板の他の面に、銅、ニッケル、クロム、錫、亜鉛、鉛又はこれらを主成分とする合金が被覆されているアルミニウムクラッド鋼板。

【請求項２】電解鉄箔、圧延鋼箔又は鋼板の片面又は両面に、銅、ニッケル、クロム、錫、亜鉛、鉛又はこれらを主成分とする合金が被覆され、その上に銅量に換算して０．１～５０ｇ／ｍｍの銅が被覆され、さらにその上に厚み５～３００μｍのアルミニウム又はアルミニウム合金の箔又は板が被覆されたアルミニウムクラッド鋼板。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】加工密着性に優れたアルミニウムクラッド鋼板に関するものである。

【０００２】

【従来の技術】アルミニウムと鋼板とのクラッド材の開発が様々な方法で進められている。例えば、冷間圧延接合法（特開昭５３－８５７５９号公報など）、有機接着剤法（特開昭６０－２２３６８３号公報など）などがある。しかし、アルミニウムの表面に存在する酸化膜の存在により、加工密着性に劣るという欠点がある。

【０００３】

【発明が解決しようとする課題】本発明の技術的課題は、接着剤を用いずに、低加圧力により、加工密着性に優れたアルミニウムクラッド鋼板を提供することである。

【０００４】

【課題を解決するための手段】本発明のクラッド鋼板は、電解鉄箔、圧延鋼箔又は鋼板の片面に、銅量に換算して０．１～５０ｇ／ｍｍの銅が被覆され、その上に厚み５～３００μｍのアルミニウム又はアルミニウム合金の箔又は板が被覆されており、前記電解鉄箔、圧延鋼箔又は鋼板の他の面に、銅、ニッケル、クロム、錫、亜鉛、鉛又はこれらを主成分とする合金が被覆されている。また、請求項２記載のクラッド鋼板は、電解鉄箔、圧延鋼箔又は鋼板の片面又は両面に、銅、ニッケル、クロム、錫、亜鉛、鉛又はこれらを主成分とする合金が被覆され、その上に銅量に換算して０．１～５０ｇ／ｍｍの銅が被覆され、さらにその上に厚み５～３００μｍのアルミニウム又はアルミニウム合金の箔又は板が被覆されている。

【０００５】

【発明の実施の形態】本発明のアルミニウムクラッド鋼板に使用される鋼箔あるいは鋼板とは、電解法あるいは圧延法により製造された鋼板をいう。また、鋼板として

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は、低炭素鋼板、クロム添加鋼板、ニッケル拡散処理した鋼板、および、銅、ニッケル、クロム、錫、亜鉛、鉛、あるいはこれらを主成分とした合金を被覆した鋼板が含まれる。もちろん、前記鋼板のアルミニウム箔あるいは板を被覆しない面にはクロメート処理、リン酸塩処理を施すことができる。一方、アルミニウムあるいはアルミニウム合金からなる圧延箔あるいは圧延板は、圧延法により製造された厚み５～３００ミクロンのアルミニウムあるいはアルミニウム合金板である。アルミニウム合金板としては、マグネシウム、マンガン、シリコン、銅、鉄、亜鉛、クロム、チタンあるいはジルコニウムを含んだ合金板が含まれる。５ミクロン未満の厚みでは作業性が低下し、製造コストが高くなり、不経済である。

【０００６】また、３００ミクロンをこえると、材料の面で不経済である。次に、良好な接合力および加工密着性を得るためには、鋼箔または鋼板、あるいは、アルミニウムまたはアルミニウム合金板の表面に、銅または銅を主成分とした合金を、銅量に換算して、０．１～５０ｇ／ｍｍ２被覆する。好ましくは１～３０ｇ／ｍｍ２被覆する。

【０００７】アルミニウムの表面の酸化物を除去した方がより均一に接合し易い。また、双方の金属板の表面に、銅または銅を主成分とした合金を被覆してもよい。その場合、接合面での全銅量が０．１～５０ｇ／ｍ２であればよい。０．１ｇ／ｍ２未満では、十分な接合力が得られず、５０ｇ／ｍ２をこすと製造コストの面で不経済である。

【０００８】また、銅板に、銅または銅を主成分とした合金を被覆する前に、ニッケル、クロム、錫、亜鉛、鉛、あるいはこれらを主成分とした合金を、０．０１～５０ｇ／ｍ２被覆してもよい。

【０００９】また、あらかじめ銅、ニッケル、クロム、錫、亜鉛、鉛、あるいはこれらを主成分とした合金を被覆した鋼板を使用してもよい。しかし、クロムまたはクロムを主成分とした合金の場合は、０．０１～２ｇ／ｍ２被覆してよい。

【００１０】また、前記の金属あるいは合金をあらかじめ被覆する場合、銅あるいは銅を主成分とした合金を被覆するときは、　　銅量に換算して０．１～５０ｇ／ｍ２被覆すればよい。好ましくは　０．５～２０ｇ／ｍ２被覆すればよい。このように、前もってニッケル、クロム、錫、亜鉛、鉛、あるいはこれらを主成分とした合金を被覆すると、結合層がより均一になり、密着性がより改善される。

【００１１】ニッケル量が５０ｇ／ｍ２、クロム量が２ｇ／ｍ２をこすと加工性が劣る。銅、ニッケル、クロム、錫、亜鉛、鉛、あるいはこれらを主成分とした合金を被覆する方法としては、電気めっき法、化学めっき法、真空蒸着めっき法などがある。

【００１２】銅を主成分とした合金には、コバルト、ビ

スマス、鉄、ゲルマニウム、インジウム、マンガン、モリブデン、ニッケル、錫、アンチモン、テルル、タリウム、亜鉛、タングステンなどを含む。

【００１３】ニッケルを主成分とした合金には、ニオブ、クロム、アルミニウム、ロジウム、チタン、コバルト、銅、鉄、ゲルマニウム、インジウム、マンガン、モリブデン、錫、アンチモン、テルル、タリウム、亜鉛、タングステンなどを含む。

【００１４】クロムを主成分とした合金には、バナジウム、コバルト、鉄、マンガン、モリブデン、錫、タングステン、ニッケルなどを含む。

【００１５】亜鉛を主成分とした合金には、ジルコニウム、バナジウム、タリウム、アンチモン、鉛、銅、インジウム、コバルト、鉄、マンガン、モリブデン、錫、タングステン、ニッケルなどを含む。

【００１６】錫を主成分とした合金には、亜鉛、ゲルマニウム、クロム、ビスマス、アンチモン、鉛、銅、インジウム、コバルト、鉄、マンガン、モリブデン、タングステン、ニッケルなどを含む。

【００１７】加熱時には、加圧力を特に必要とせず、板を単に重ねるだけでよいが、均一に接合するためには、好ましくは０．０１～２００ｋｇｆ／ｃｍ２の範囲で加圧するのがよい。

【００１８】加熱は、真空、不活性、非酸化性の雰囲気で、箔、板を３００℃～アルミニウムまたはアルミニウム合金の融点未満の温度（約６５０℃）にする。３００℃未満では密着性に劣り、融点以上ではアルミニウムが溶融するため作業性を悪くする。

【００１９】加熱時間は、被覆する金属の種類や厚みによって異なるが、０．１秒～１５分程度でよい。０．１秒未満では、均一に密着しにくく、１５分をこえると不経済である。

【００２０】アルミニウムクラッドは、鋼箔または鋼板の片面あるいは両面に施すことができる。雰囲気は、非酸化性雰囲気、例えば、水素、窒素、ヘリウム、ネオン、アルゴン、またはこれらの混合ガスなどが好ましい。

【００２１】一方、アルミニウムは、圧延法により製造された厚さ５～１００μｍのアルミニウム箔である。５μｍ未満の厚みでは作業性が低下し、１００μｍを越えると材料費の面で不経済である。また、非接合面にはクロメート処理，リン酸処理などの化成処理を施すことができる。

【００２２】鋼板とアルミニウムを冷間圧延により接合を行う際に、まず鋼板にニッケルあるいはニッケルを主成分とした合金めっきを０．５～５ｇ／ｍ²施す。ニッケルあるいはニッケルを主成分とした合金を被覆する方法は、特に制限されるものではないが、これらの方法としては電気めっき法，化学めっき法がある。ニッケルを主成分とした合金には、リン，コバルト，銅，クロム，

亜鉛，スズあるいは鉄を含むことができる。

【００２３】

【実施例】

（実施例１）厚み１００μｍのアルミニウム箔（ＪＩＳ１１００材）を、ｐ－３アンザー（ヘンケル白水社製）３０ｇ／ｌを含んだ溶液中に、温度６０℃の条件で５秒浸漬した。厚み２００μｍの鋼板に、ピロリン酸銅９０ｇ／ｌ、ピロリン酸カリウム３３０ｇ／ｌを含んだ溶液を用いて、５０℃、電流密度５Ａ／ｄｍ２の条件で、銅を５０ｇ／ｍ２めっきした。ついで、アルミニウム箔と銅めっきした鋼板とを重ね、圧力０．０４ｋｇｆ／ｃｍ２をかけ、窒素ガス９５％と水素ガス５％を含んだ雰囲気中で、板の温度６１０℃で１０分加熱してアルミニウムクラッド鋼板を得た。

【００２４】（実施例２）厚み５μｍのアルミニウム箔（ＪＩＳ１０７０材）を、水酸化ナトリウム５０ｇ／ｌを含んだ溶液中に、温度６０℃の条件で５秒浸漬した。厚み２５０μｍの鋼板を、硫酸銅２５０ｇ／ｌ、硫酸５０ｇ／ｌを含んだ５０℃溶液を用いて、浸漬して、両面に銅を２０ｇ／ｍ２めっきした。ついで、銅めっきした鋼板の両面にアルミニウム箔を重ね、圧力１．０ｋｇｆ／ｃｍ２をかけ、窒素ガス９５％と水素ガス５％を含んだ雰囲気中で、板の温度６１０℃で１秒加熱してアルミニウムクラッド鋼板を得た。

【００２５】（実施例３）厚み３０μｍのアルミニウム合金箔（ＪＩＳ３００３材）を、硫酸銅２５０ｇ／ｌ、硫酸５０ｇ／ｌを含んだ溶液中に、温度４０℃、電流密度５Ａ／ｄｍ２の条件で、銅を１０ｇ／ｍ２めっきした。ついで、銅めっきしたアルミニウム合金箔を、厚み２００μｍの鋼板に重ね、圧力０．５ｋｇｆ／ｃｍ２をかけ、水素ガスの雰囲気中で、板の温度６００℃で３０秒加熱してアルミニウムクラッド鋼板を得た。

【００２６】（実施例４）厚み５０μｍのアルミニウム箔（ＪＩＳ１０７０材）を、水酸化ナトリウム１００ｇ／ｌを含んだ溶液中で、温度６０℃で電流密度１０Ａ／ｄｍ２の条件で、アルミニウム箔を陰極として、５秒間処理した。厚み１００μｍの鋼箔に、ワット浴（硫酸ニッケル２４０ｇ／ｌ、塩化ニッケル４５ｇ／ｌ、ホウ酸３０ｇ／ｌ）を用い、温度５０℃、電流密度５Ａ／ｄｍ２の条件で、ニッケルを０．０１ｇ／ｍ２めっきした。ついで、ニッケルめっきした鋼箔に、硫酸銅２５０ｇ／ｌ、硫酸５０ｇ／ｌを含んだ溶液を用いて、温度５０℃、電流密度５Ａ／ｄｍ２の条件で、銅を３ｇ／ｍ２めっきした。ついで、アルミニウム箔とニッケルめっき後銅めっきした鋼箔とを重ね、圧力０．０４ｋｇｆ／ｃｍ２をかけ、アルゴンガス雰囲気中で、箔の温度６３０℃で１分加熱してアルミニウムクラッド鋼板を得た。

【００２７】（実施例５）厚み２００μｍのアルミニウム合金板（ＪＩＳ５０５２材）に、硫酸銅２５０ｇ／ｌ、硫酸５０ｇ／ｌを含んだ溶液中に、温度４０℃、電

流密度5A／dm2の条件で、銅を2g／m2めっきした。ついで、厚み70μmの鋼箔に、　ピロリン酸銅90g／l、ピロリン酸カリウム330g／lを含んだ溶液を用いて、50℃、電流密度5A／dm2の条件で、銅を3g／m2めっきした。ついで、銅めっきしたアルミニウム合金板と、銅めっきした鋼箔を重ね、圧力0.01kgf／cm2をかけ、窒素ガス95%と水素ガス5%を含んだ雰囲気中で、板の温度650℃で1秒加熱してアルミニウムクラッド鋼板を得た。

【0028】（実施例6）厚み300μmのアルミニウム合金板（JIS5082材）に、ピロリン酸銅90g／l、ピロリン酸カリウム330g／lを含んだ溶液を用いて、50℃、電流密度5A／dm2の条件で、銅を10g／m2めっきした。ついで、厚み30μmの鋼箔に、ワット浴（硫酸ニッケル240g／l、塩化ニッケル45g／l、ホウ酸30g／l）を用い、温度50℃、電流密度10A／dm2の条件で、ニッケルを0.5g／m2めっきした。このニッケルめっきした鋼箔に、硫酸銅30g／l、硫酸第1鉄300g／l、硫酸アンモニウム30g／lを含んだ溶液を用いて、温度50℃、電流密度10A／dm2の条件で、銅ー鉄合金めっきを、銅に換算して5g／m2めっきした。ついで、銅めっきしたアルミニウム合金板と、ニッケルめっき後銅ー鉄合金めっきした鋼箔を重ね、圧力10kgf／cm2をかけ、窒素ガス95%と水素ガス5%を含んだ雰囲気中で、板の温度590℃で1分加熱してアルミニウムクラッド鋼板を得た。

【0029】（実施例7）厚み200μmのアルミニウム合金板（JIS3004材）に、硫酸銅5g／l、硫酸ニッケル5g／l、酒石酸アンモニウム13g／l、水酸化アンモニウム0.025g／lを含んだ溶液を用いて、温度30℃、電流密度5A／dm2の条件で、銅ーニッケル合金を、銅に換算して0.05g／m2めっきした。ついで、厚み15μmの電解鉄箔に、ワット浴（硫酸ニッケル240g／l、塩化ニッケル45g／l、ホウ酸30g／l）を用い、温度50℃、電流密度10A／dm2の条件で、ニッケルを50g／m2めっきした。このニッケルめっきした鉄箔に、ピロリン酸銅90g／l、ピロリン酸カリウム330g／lを含んだ溶液を用いて、50℃、電流密度5A／dm2の条件で、銅を10g／m2めっきした。ついで、銅ーニッケル合金めっきしたアルミニウム合金板と、ニッケルめっき後銅めっきした鉄箔を重ね、圧力50kgf／cm2をかけ、窒素ガス95%と水素ガス5%を含んだ雰囲気中で、板の温度580℃で15分加熱してアルミニウムクラッド鋼板を得た。

【0030】（実施例8）厚み70μmのアルミニウム箔（JIS1070材）を、p－3アンザー（ヘンケル白水社製）30g／lを含んだ溶液中に、温度60℃の条件で10秒浸漬した。厚み210μmの鋼板に、サージェント浴（無水クロム酸250g／l、硫酸2.5g／l）を用いて、50℃、電流密度20A／dm2の条件で、クロムを0.01g／m2めっきした。ついで、クロムめっきした鋼板に、ピロリン酸銅90g／l、ピロリン酸カリウム330g／lを含んだ溶液を用いて、50℃、電流密度5A／dm2の条件で、銅を3g／m2めっきした。ついで、アルミニウム箔とクロムめっき後銅めっきした鋼板とを重ね、圧力2kgf／cm2をかけ、窒素ガス雰囲気中で、板の温度600℃で15分加熱してアルミニウムクラッド鋼板を得た。

【0031】（実施例9）厚み150μmのアルミニウム合金板（JIS5082材）に、ピロリン酸銅90g／l、ピロリン酸カリウム330g／lを含んだ溶液に水酸化ナトリウムを添加してpH11.5にした溶液を用いて、60℃で浸漬して、銅を0.05g／m2めっきした。ついで、錫を2.8g／m2被覆した厚み200μmの錫めっき鋼板に、ピロリン酸銅90g／l、ピロリン酸カリウム330g／lを含んだ溶液を用いて、50℃で電流密度5A／dm2の条件で、銅を0.05g／m2めっきした。この銅めっきしたアルミニウム合金板と、銅めっきした錫めっき鋼板を重ね、圧力200kgf／cm2をかけ、窒素ガス雰囲気中で、板の温度301℃で5分加熱してアルミニウムクラッド鋼板を得た。

【0032】（実施例10）厚み250μmのアルミニウム板（JIS1100材）を、p－3アンザー（ヘンケル白水社製）30g／lを含んだ溶液中に、温度60℃の条件で10秒浸漬した。厚み50μmの鋼箔に、サージェント浴（無水クロム酸250g／l、硫酸2.5g／l）を用いて、50℃、電流密度20A／dm2の条件で、クロムを2g／m2めっきした。ついで、クロムめっきした鋼箔に、ピロリン酸銅90g／l、ピロリン酸カリウム330g／lを含んだ溶液を用いて、50℃、電流密度5A／dm2の条件で、銅を10g／m2めっきした。ついで、アルミニウム板とクロムめっき後銅めっきした鋼箔とを重ね、圧力5kgf／cm2をかけ、窒素ガス雰囲気中で、板の温度600℃で3分加熱してアルミニウムクラッド鋼板を得た。

【0033】このようにして得られたアルミニウムクラッド鋼板を、次のような加工密着性試験を行った。エリクセン試験機（東京衡機製造所製）により、アルミニウムまたはアルミニウム合金板側が張り出るように、6mm張り出した。アルミニウムまたはアルミニウム合金板の表面の張り出し部にカッターで十字に地鉄部に達するまで傷をつけて、ピンセットで強制的に剥離テストを実施した。その結果、実施例1～10のクラッド鋼板は剥離がみられなかった。

【0034】

【発明の効果】鋼板と、アルミニウムまたはアルミニウム板の間に銅などを介在させることにより、非酸化性雰

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囲気中で強固な接合力を有するアルミニウムクラッド鋼板が得られる。また、ニッケル、クロム、錫、亜鉛、鉛、あるいはこれらを主成分とした合金を被覆すると、

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熱処理時において、鉄とアルミニウム間での拡散が抑制されるため、より均一な接合層が形成され、加工密着性も向上する。